In re Application of:

Brian Patterson, et al.	§	Confirmation No.	9035
	§		
Serial No.: 10/830,204	§	Group Art Unit:	2195
	§		
Filed: April 21, 2004	§	Examiner:	To, Jennifer N.
	§		
For: TASK MANAGEMENT BASED ON	§	Atty Docket:	200310878-1
SYSTEM UTILIZATION	§		HPQB:0080
	§		

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APPEAL BRIEF PURSUANT
TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in response to the Final Office Action mailed on

October 27, 2009, and in furtherance of a Notice of Appeal filed January 7, 2010.

1.   **REAL PARTY IN INTEREST**

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 11445 Compaq Center Dr. W, Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

2.   **RELATED APPEALS AND INTERFERENCES**

The Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3.   **STATUS OF CLAIMS**

Claims 1-8 and 10-20 are currently pending, are currently under rejection and, thus, are the subject of this appeal. Claim 9 was canceled during prosecution and, accordingly, not subject to this appeal.

4.   **STATUS OF AMENDMENTS**

There are no outstanding amendments to be considered by the Board.

5.   **SUMMARY OF CLAIMED SUBJECT MATTER**

The Application contains four independent claims, namely, claims 1, 8, 16, and 19, all of which are the subject of this Appeal. The Application also contains a dependent claim 7, which is also the subject of this Appeal. As an example, each of the independent claims relate generally to a method of managing task execution in a storage system. *See* Application, p. 3, ll. 15-16; p. 4, ll. 11-13; p. 5, ll. 19-21; p. 9, ll. 8-10. The application also contains dependent claims 2-7, 9-15, 17, 18, and 20. The subject matter of claims 1, 8, 16, and 19 is summarized below.

With regard to independent claim 1, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 1 recites a method of managing task execution in a storage system. *See id.* at p. 3, ll. 16-17; p. 5, ll. 19-21; p.9, ll. 8-10. A parameter indicative of workload of an interface (*e.g.*, 302, 402) to a storage system may be measured. *See id.* at p. 3, ll. 16-19; p. 4, ll. 6-18; p. 5, ll. 22-24; p. 6, ll. 8-26; p. 7, ll. 10-19; p. 9, ll. 16-18; Figs. 3 and 4. A priority may be assigned to tasks that are executable on the system. *See id.* at p. 2, ll. 19-23; p. 3, ll. 16-19; p. 5, ll. 24-26; p. 9, l. 12. The assignment may be based on the measured parameter. *See id.* at p. 3, ll. 12-19; p. 5, ll. 5-26; p. 9, ll. 8-25. Assigning priority may comprise assigning an allowable utilization value to individual tasks. *See id.* at p. 4, ll. 14-23; p. 4, l. 28 - p. 5, l. 4; p. 7, ll. 28-30; p. 8, ll. 10-13. The allowable utilization value may be a value at which the individual tasks are authorized to execute. *See id.* at p. 4, ll. 14-21; p. 5, ll. 5-13; p. 6, ll. 25-28; p. 7, ll. 8-10; p. 8, ll. 10-13. The allowable utilization value may be indicative of the importance of the task and correlative to the parameter. *See id.* at p. 5, ll. 22-24; p. 7, l. 28 – p. 8, l. 3.

With regard to dependent claim 7, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 7 recites the method of claim 1 further comprising maintaining a data structure associated with a utilization task queue. *See id.* at p. 5, ll. 3-8. The data structure may be indicative of allowable utilization of all tasks on the queue. *See id.* The method may also comprise executing or deferring execution of all tasks on the utilization task queue based on the data structure and a measurement of current utilization. *See id. at* p. 5, ll. 8-12.

With regard to independent claim 8, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 8 recites an array controller (*e.g.*, 300, 400) that may comprise a physical interface (*e.g.*, 302, 402) that is capable of coupling to a storage array (*e.g.*, 304), and a memory which may comprise control logic (*e.g.*, 306, 406). *See id.* at p. 5, ll. 18-23; p. 9,

ll. 14-15; Figs. 3 and 4. The control logic (*e.g.*, 306, 406) may include executable code (*e.g.*, 308, 408) that may comprise a performance measurement utility (*e.g.*, 310, 410), a task management utility (*e.g.*, 312, 414), and a queuing utility (*e.g.*, 314, 412). *See id.* at p. 5, ll. 22-24; p. 6, ll. 20-22; p. 8, ll. 4-6; p. 9, ll. 16-17; Figs. 3 and 4. The performance measurement utility (*e.g.*, 310, 410) may measure a parameter indicative of storage array input/output (I/O) workload. *See id.* at p. 3, ll. 16-19; p. 5, ll. 22-24; Figs. 3 and 4. The task management utility (*e.g.*, 312, 414) may assign priority of tasks executable on the storage array (*e.g.*, 304, 404) based on the measured parameter. See *id.* at p. 2, ll. 19-23; p. 3, ll. 16-19; p. 5, ll. 24-26; p. 9, l. 12; Figs. 3 and 4. Each task may be assigned a value of the parameter at which the task is authorized to execute if the measured parameter value is below the assigned value. *See id.* at p. 4, ll. 14-21; p. 5, ll. 5-13; p. 6, ll. 25-28; p. 7, ll. 8-10; p. 8, ll. 10-13. The assigned value may be indicative of a priority of the task. *See id.* at p. 7, l. 28 – p. 8, l. 3. The queuing utility (*e.g.*, 314, 412) may maintain a task queue. *See id.* at p. 6, ll. 20-25; p. 8, ll. 4-6; Figs. 3 and 4. The queuing utility (*e.g.*, 314, 412) may also process the tasks based at least in part on the assigned values and the measured parameter values. *See id.* at p. 6, ll. 20-25; p. 8, ll. 10-13; Figs. 3 and 4.

With regard to independent claim 16, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 16 recites an array controller (*e.g.*, 300, 400) comprising a physical interface (*e.g.*, 302, 402) capable of coupling to a storage array (*e.g.*, 304, 404), and a memory comprising control logic (*e.g.*, 306, 406). *See id.* at p. 5, ll. 18-23; p. 9, ll. 14-15; Figs. 3 and 4. The control logic (*e.g.*, 306, 406) may include executable code (*e.g.*, 308, 408) that may comprise a performance measurement utility (*e.g.*, 310, 410), a queue manager (*e.g.*, 314, 412), and a task management utility (*e.g.*, 312, 414). *See id.* at p. 5, ll. 22-24; p. 6, ll. 20-22; p. 8, ll. 4-6; p. 9, ll. 16-17; Figs. 3 and 4. The performance measurement utility (*e.g.*, 310, 410) may measure a parameter indicative of storage array input/output (I/O) workload. *See id.* at p. 3, ll. 16-19; p. 5, ll. 22-24; Figs. 3 and 4. The queue manager (*e.g.*, 314, 412) may maintain a task queue of tasks assigned an I/O workload threshold value, wherein the threshold value is indicative of priority of the task.

See id. at p. 5, ll. 22-24; p. 6, ll. 20-25; p. 7, l. 28 – p. 8, l. 3; Figs. 3 and 4. The task management utility (*e.g.*, 312, 414) may execute tasks acting on the storage array (*e.g.*, 304, 404) with a priority based on the storage array I/O workload parameter and the order on the task queue. See *id.* at p. 2, ll. 19-23; p. 3, ll. 16-19; p. 5, ll. 24-26; p. 9, l. 12; Figs. 3 and 4.

With regard to independent claim 19, discussions of the recited features can be found at least in the below-cited locations of the specification and drawings. By way of example, claim 19 recites an article of manufacture comprising a controller (*e.g.*, 300, 400) comprising a computer readable medium having a computable readable program code embodied therein for managing task execution in a storage array (*e.g.*, 304, 404). *See id.* at p. 3, ll. 16-17; p. 5, ll. 19-21; p.9, ll. 8-10; Figs. 3 and 4. The computable readable program code may comprise a code capable (*e.g.*, 308, 408) of causing the controller (*e.g.*, 300, 400) to measure a parameter indicative of storage array input/output (I/O) workload comprising a sum of utilization of an I/O device. *See id.* at p. 3, ll. 16-19; p. 5, ll. 22-24; Figs. 3 and 4. The computable readable program code may further comprise a code (*e.g.*, 308, 408) capable of causing the controller (*e.g.*, 300, 400) to assign priority of tasks executable on the storage array (*e.g.*, 304, 404) based on the measured parameter. See *id.* at p. 2, ll. 19-23; p. 3, ll. 16-19; p. 5, ll. 24-26; p. 9, l. 12; Figs. 3 and 4. The computable readable program code may also comprise a code (*e.g.*, 308, 408) capable of causing the controller (*e.g.*, 300, 400) to maintain a queue of tasks with each task assigned a threshold utilization, wherein the threshold utilization is indicative of importance of the tasks. *See id.* at p. 7, l. 28 – p. 8, l. 3; Figs. 3 and 4.

6.   **GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

        A.   First Ground of Rejection for Review on Appeal

        The Appellants respectfully urge the Board to review and reverse the Examiner's first ground of rejection in which the Examiner rejected claims 19 and 20 under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter.

B.   Second Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected claims 1-7 under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Appellants regard as the invention.

C.   Third Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claims 1, 4, 7, 8, 10, 14-16, 19, and 20 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2002/0091746 by Umberger, et al. (hereinafter "Umberger").

D.   Fourth Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's fourth ground of rejection in which the Examiner rejected claim 2 under 35 U.S.C. § 103(a) as being unpatentable over Umberger in view of U.S. Patent No. 7,159,071 to Ikeuchi (hereinafter "Ikeuchi").

E.   Fifth Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's fifth ground of rejection in which the Examiner rejected claim 3 under 35 U.S.C. § 103(a) as being unpatentable over Umberger, as applied in claim 1 above, and in view of U.S. Patent Application Publication No. 2004/0205102 by Elliott, Jr., et al. (hereinafter "Elliott").

F.   Sixth Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's sixth ground of rejection in which the Examiner rejected claims 5, 6, 12, 13, and 17 under 35 U.S.C. § 103(a) as being unpatentable over Umberger, as applied in claims 1, 8, and

16 above, and in view of U.S. Patent No. 6,157,963 to Courtright II, et al. (hereinafter "Courtright").

G. Seventh Ground of Rejection for Review on Appeal

The Appellants respectfully urge the Board to review and reverse the Examiner's seventh ground of rejection in which the Examiner rejected claims 11 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Umberger, as applied in claims 8 and 16 above, and in view of U.S. Patent No. 7,152,142 to Guha, et al. (hereinafter "Guha").

7. ARGUMENT

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under 35 U.S.C. §§ 101, 112, second paragraph, and 103(a). Accordingly, the Appellants respectfully request full and favorable consideration by the Board, as the Appellants assert that claims 1-8 and 10-20 are currently in condition for allowance.

A. Ground of Rejection No. 1

With respect to the rejection of claims 19 and 20 under 35 U.S.C. § 101 as being directed to non-statutory subject matter, the Examiner focused on claim 19, specifically stating:

> As per claims 19-20, they recited "an article of manufacture" comprising computer readable medium. Wherein the computer readable medium as defined in the specification, paragraph [0034], as any means that can propagate the program for use by the device (i.e. could include a carrier wave signal). The program code embedded in a carrier wave signal does not produce a tangible result. Therefore, claims 19-20 are directed to non-statutory subject matter.

Final Office Action, p. 2. The Appellants respectfully traverse this rejection.

The Examiner has the burden of setting forth a *prima facie* case that the claimed subject matter falls outside of the statutory categories defined in 35 U.S.C. § 101. M.P.E.P. § 2100 (IV)(B). Section 101 states that

> [w]hoever invents or discovers any new and useful *process*, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

35 U.S.C. § 101 (emphasis added). The Supreme Court has held that Congress intended this statute to include "anything under the sun that is made by man." *Diamond v. Chakrabarty*, 447 U.S. 303, 308-09, 206 U.S.P.Q. 193, 197 (1980). However, abstract ideas, natural phenomena, and laws of nature are not eligible for patent protection. *Diamond v. Diehr*, 450 U.S. 175, 185, 209 U.S.P.Q. 1, 7 (1981).

The statute lists four statutory categories, or classes, of patentable subject matter: processes, machines, manufactures, and composition of matter. *See* 35 U.S.C. § 101. The latter three categories are things, while the first category defines actions. *See* M.P.E.P. § 2100 (IV)(A). On August 24, 2009, interim examination instructions were issued to the Technology Center Directors in light of a pending Supreme Court decision in *Bilski v. Kappos*. *See* New Interim Patent Subject Matter Eligibility Examination Instructions, p. 1. While these examination instructions do not have the force and effect of law, they provide guidance for examining claims under 35 U.S.C. § 101 for subject matter eligibility. *See id.*, p. 2.

The first step according to the examination instructions is to determine if the claim is directed to a process, machine, manufacture, or composition of matter. *See id.* The examination instructions expressly define a machine as "a concrete thing, consisting of ...certain devices and combination of devices." *See id.*

In rejecting claims 19 and 20, the Examiner's focus is on a computer readable medium recited in claim 19. *See* Final Office Action, p. 2. However, claim 19 recites, *inter alia*, "An article of manufacture comprising… *a controller comprising* a computer readable medium having a computable readable program *code embodied therein for managing task execution in a storage array*." A controller that includes code to manage task execution in a storage array, such as the array controllers 300 or 400, clearly represents a physical device. Accordingly, claim 19 recites a machine, which is patent eligible subject matter under 35 U.S.C. § 101.

For at least the same reasons, claim 20, which depends from claim 19 recites patent eligible subject matter and is also allowable. Therefore, the Appellants respectfully request that the Examiner withdraw the rejection under 35 U.S.C. § 101 and allow claims 19-20 to issue.

B. Ground of Rejection No. 2

The Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected claims 1-7 under 35 U.S.C. § 112, second paragraph as being indefinite for failing to point out and distinctly claim the subject matter which the Appellants regard as the invention. The Examiner focused on claim 1, specifically stating:

> as per claim 1, lines 3-4, it is not clearly understood what is meant by "measuring a parameter indicative of workload of an interface to a storage system" (i.e. measuring the workload of the storage controller or the workload of the storage system). For the purposed of examination, examiner will interpreted the limitation as "measuring the workload of the storage system").

Final Office Action, p. 3. The Appellants respectfully traverse this rejection.

The Examiner's focus during examination of claims for compliance with the requirement for definiteness under 35 US.C. § 112, second paragraph, is whether the claim meets the threshold requirements of clarity and precision, not whether more

suitable language or modes of expression are available. *See* M.P.E.P. § 2173.02. The Appellant may use functional language, alternative expressions, negative limitations, or any style of expression or format of claim which makes clear the boundaries of the subject matter for which protection is sought. *See* M.P.E.P. §§ 2173.01 and 2173.05; *In re Swinehart,* 160 US.P.Q. 226, (C.C.P.A. 1971). The Examiner is also reminded not to equate breadth of a claim with indefiniteness. *In re Miller,* 441 F.2d 689, 169 US.P.Q. 597 (C.C.P.A. 1971).

The essential inquiry pertaining to the definiteness requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. As set forth in Section 2173 of the Manual of Patent Examining Procedure, definiteness of claim language must be analyzed, not in a vacuum, but in light of

> (A) The content of the particular application disclosure;
> (B) The teachings of the prior art; and
> (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

In reviewing a claim for compliance with 35 U.S.C. § 112, second paragraph, the Examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. § 112, second paragraph, by providing clear warning to others as to what constitutes infringement of the patent. *See Solomon* v. *Kimberly-Clark Corp.,* 55 U.S.P.Q.2d 1279, 1283 (Fed. Cir. 2000). Only when a claim remains insolubly ambiguous without a discernible meaning after all reasonable attempts at construction must it be declared indefinite. *See Metabolite Labs., Inc.* v. *Lab. Corp. of Am. Holdings,* 71 U.S.P.Q.2d 1081, 1089 (Fed. Cir. 2004). Accordingly, a claim term that is not used or defined in the specification is not indefinite if the meaning of the claim term is discernible. *See Bancorp Services, L.L.C.* v. *Hartford Life Ins. Co.,* 69 U.S.P.Q.2d 1996, 1999-2000 (Fed. Cir. 2004).

In other words, a claim is not to be presumed indefinite merely because the claim includes a broad term. If the scope of the subject matter embraced by the claims is clear, and if the Appellants have not otherwise indicated that they intend the invention to be of a scope different from that defined in the claims, then the claims comply with 35 U.S.C. § 112, second paragraph. *See* M.P.E.P. § 2173.04.

The Examiner asserts that claim 1 is indefinite because claim 1 is not clear as to whether claim 1 recites "measuring the workload of the storage controller or the… storage system." *See* Final Office Action, p. 3. Respectfully, claim 1 does not recite measuring *the workload* of the storage controller, nor *the workload* of the storage system. Rather, claim 1 recites "measuring a parameter."

Claim 1 does recite the parameter may be "indicative of workload of an *interface* to a storage system." However, the "workload of an interface" is not a reference to the workload of a storage system because a storage system (*e.g.*, Fig. 3, Fig. 4) is not an interface (*e.g.* 302, 402). A controller (*e.g.*, 300, 400) is not an interface either. In fact, the word, controller, is not recited in any of the limitations of claim 1. Rather, claim 1 recites clear boundaries of the subject matter for which protection is sought, "measuring a parameter indicative of workload of an interface to a storage system." Accordingly, claim 1 is allowable under 35 U.S.C. § 112, second paragraph.

Claim 4 recites, *inter alia*, "measuring the parameter to obtain a current utilization value." The Examiner asserts that claim 4 is unclear as to whether "the measured parameter of claim 1" is measured, or whether a second measurement is conducted using the "original parameter." *See id.* Respectfully, claims 1 and 4 recite only one parameter. As such, it is unclear as to why the Examiner interprets claim 4 to recite to an "original" parameter. Claim 1 recites, *inter alia*, "measuring *a* parameter." Claim 4 recites, *inter alia*, "The method according to Claim 1 further comprising…measuring *the* parameter to obtain a current utilization value." The parameter in claims 1 and 4 are the same

parameter. Accordingly, the Appellants respectfully assert that claim 1 is not indefinite under 35 U.S.C. § 112, second paragraph.

Regarding claim 5, the Appellants respectfully assert that the reference to "the queue" is not insolubly ambiguous. The Application makes numerous references to the "queue that bases execution on assigned allowable utilization and measured utilization." *See* Application, p. 4, ll. 16-25; p. 6, ll. 20-28; p. 7, ll. 8-10; p. 8, ll. 4-6, ll. 20-23; p. 9, ll. 23-26. Accordingly, claim 5 is not insolubly ambiguous.

For these reasons, the Appellants assert that claims 1, 4, and 5 are not insolubly ambiguous. Accordingly, the Appellants respectfully request that the Board reverse the rejections under 35 U.S.C. § 112, Second Paragraph.

C.   Ground of Rejection No. 3

The Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claims 1, 4, 7, 8, 10, 14-16, 19, and 20 under 35 U.S.C. § 103(a) as being unpatentable over Umberger. The Examiner focused on claims 1, 8, 16, and 19 specifically stating:

> As per claim 1, Umberger teaches the invention substantially as claimed including a method of managing task execution in a storage system (abstract) comprising:
> measuring a parameter indicative of storage system workload (paragraphs [0039], [0047], [0050], [0056]); and
> assigning priority of tasks executable on the system based on the measured parameter (paragraphs [0005], [0008], [0011]-[0012], [0040], [0059]-[0063]), wherein assigning comprises assigning to individual tasks an allowable utilization value at which the individual tasks are authorized to execute (paragraphs [0062], [0065]).
> Umberger did not specifically teach the allowable utilization value is indicative of importance of the task.
> However, Umberger teaches that assigning to individual tasks an allowable utilization value at which the individual tasks are authorized to execute when the capacity of the system change (paragraphs [0062], [0065]).

It would have been obvious to one of an ordinary
skill in the art at the time the invention was made to have
recognized that the more the priority of the task is the more
resources the task going to get. Thus, when the allowable
utilization value at which the individual tasks are
authorized to execute high, it is indicated that the individual
tasks is importance. Therefore, it would have been obvious
to one of an ordinary skill in the art at the time the
invention was made to utilize Umberger's system as
modified to allocate execution of tasks based on details
characteristic of a workload (Umberger, paragraph [0012]).

Final Office Action, pp. 4-5. Claims 8, 16 and 19 are rejected for similar reasons described above. The Appellants respectfully traverse these rejections.

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). To *establish prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka, 180 U.S.P.Q.* 580 (C.C.P.A. 1974). Although a showing of obviousness under 35 U.S.C. § 103 does not require an express teaching, suggestion or motivation to combine prior art references, such a showing has been described by the Federal Circuit as providing a "helpful insight" into the obviousness inquiry. *KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350, 550 U.S. 398, 82 U.S.P.Q.2d 1385 (2007). Moreover, obviousness cannot be established by a mere showing that each claimed element is present in the prior art. *Id.* The Examiner must cite a compelling reason why a person having ordinary skill in the art would combine known elements in order to support a proper rejection under 35 U.S.C. § 103. *Id.*

Claim 1 recites, *inter alia*, "assigning to individual tasks an allowable utilization value at which the individual tasks are authorized to execute." Claims 8, 16, and 19 recite similar limitations.

In contrast, Umberger, does not disclose "assigning… an allowable utilization value at which… individual tasks are authorized to execute." Rather, Umberger discloses

"a data structure that connects each distinguishable workload or workload identifier 701 with a performance requirement 702." *See* Umberger, para. [0060].

The performance requirement is not the "allowable utilization value" recited in claim 1. Rather, utilization, which may also be referred to as workload, may be defined using a number of measurements that accurately reflect the state of storage array. *See* Application, p. 3, ll. 24-27; p. 4, ll. 1-8. For example, input-output (I/O) operations per unit of time may reflect workloads ranging from idle to heavy, depending upon the number of I/Os per millisecond. *See id.* An allowable utilization value may be a maximum rate of utilization, beyond which a new task may not be allowed to additionally burden the storage array. *See id.*, p. 4, ll. 14-23.

In contrast, the performance requirement "represents the *minimum* performance level *preferred* for each workload." *See* Umberger, para. [0062] (emphasis added). For example, the performance requirement may specify that 70% of available processing power of a CPU is preferred for a particular work request. *See id.*, para. [0067]. Umberger discloses that the work request "should not be given any less" than the specified performance requirement. However, the work request may not be assigned even the *minimum* performance requirement when executing. *See id.*, para. [0063].

The minimum amount of performance preferred for a particular item of work is different than a maximum allowable utilization value for a task. While both may represent thresholds, those thresholds are at opposite ends of a spectrum. Umberger discloses a *minimum*, while claim 1 recites a *maximum*.

Additionally, the task recited in claim 1 is only "authorized to execute" if the maximum allowable utilization value is *not* exceeded. In contrast, Umberger's work items may execute whether or not the minimum threshold is met.

Further, the allowable utilization value represents utilization of the storage array without the demands of the task with the assigned utilization value. *See* Application, p. 4, ll. 14-23. In contrast, Umberger's performance requirement is the service demand of a particular work item on a computer system component. *See* Umberger, para. [0067].

Also, Umberger does not disclose assigning the performance requirement. Instead, Umberger merely discloses a data structure comprising a workload identifier and a performance requirement, without disclosing how the data structure is populated. Accordingly, Umberger does not disclose "assigning… an allowable utilization value," as recited in claim 1.

It should also be noted that the Examiner concedes that Umberger does not disclose "allowable utilization value is indicative of importance of the task," as recited in claim 1. However, the Examiner rejects claim 1 under 35 U.S.C. § 103 without combining Umberger with another prior art reference. Instead, the Examiner asserts, without a second reference, without taking official notice, and without any support, that tasks of high priority receive "more resources." *See* Final Office Action, p. 5.

The Appellants submit that the allowable utilization value is not "more resources." As described above, utilization may be defined using a number of measurements that accurately reflect the state of storage array. *See* Application, p. 3, ll. 24-27; p. 4, ll. 1-8. "More resources" do not describe measurements that accurately reflect the state of the storage array. Accordingly, "more resources" are not the "allowable utilization value," recited in claim 1. As such, Umberger and the Examiner's unsupported assertion regarding "more resources," alone or in any hypothetical combination, fail to disclose the allowable utilization value recited in claim 1.

Additionally, claim 7 recites, *inter alia*, "maintaining a data structure associated with a utilization task queue indicative of allowable utilization of all tasks on the queue," which Umberger does not disclose. Rather, Umberger discloses a request queue that

contains incoming work requests. *See* Umberger, para. [0039]. While Umberger discloses statistics relating to computational demands of the requests in the request queue, those statistics are not "indicative of allowable utilization of *all* tasks on the queue," as recited in claim 1.

For at least the reasons discussed above, Umberger and the Examiner's unsupported assertion, alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claims 1, 8, 16, and 19. Accordingly, these claims are allowable over Umberger. For at least the same reasons, their dependent claims 4, 7, 10, 14, 15, and 20 are allowable over Umberger. The Appellants respectfully request that the Board reverse the rejection of present claims under 35 U.S.C. § 103(a).

D.   Ground of Rejection No. 4

The Appellants respectfully urge the Board to review and reverse the Examiner's fourth ground of rejection in which the Examiner rejected claim 2 under 35 U.S.C. § 103(a) as being unpatentable over Umberger as applied in claim 1 above, and in view of Ikeuchi.

For at least the reasons discussed above, the cited references, alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claim 1. Accordingly, claim 2, which depends from claim 1 is allowable over Umberger for at least the same reasons. Further, Ikeuchi does not remedy the deficiencies of Umberger.

Rather, Ikeuchi discloses a method for balancing disk load on a storage system. *See* Ikeuchi, Abstract. Ikeuchi does not disclose "assigning… an allowable utilization value at which… individual tasks are authorized to execute," as recited in claim 1. Rather, Ikeuchi's focus is preventing time out errors for I/O requests by prioritizing requests from a host in concert with internal I/O requests. *See id.,* Abstract; col. 7, ll. 3-34. In fact, the Examiner merely cites to Ikeuchi in support of the assertion that Ikeuchi

discloses," the parameter comprises host input/output operations per units time and counting a number of… operations." *See* Final Office Action, p. 8.

Accordingly, the references, alone, or in any hypothetical combination, fail to show all of the limitations of claim 2. Appellants respectfully request that the Board reverse the rejection of claim 2 under 35 U.S.C. § 103(a).

E.   Ground of Rejection No. 5

The Appellants respectfully urge the Board to review and reverse the Examiner's fifth ground of rejection in which the Examiner rejected claim 3 under 35 U.S.C. § 103(a) as being unpatentable over Umberger as applied in claim 1 above, and in view of Elliott.

For at least the reasons discussed above, the cited references, alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claim 1. Accordingly, claim 3, which depends from claim 1, is allowable over Umberger for at least the same reasons. Further, Elliot does not remedy the deficiencies of Umberger.

Rather, Elliot discloses a method for estimating bandwidth taken up by network management tasks. *See* Elliot, Abstract. Elliot does not disclose "assigning… an allowable utilization value at which… individual tasks are authorized to execute," as recited in claim 1. Rather, Elliot discloses estimating *network management* bandwidth using statistics regarding bandwidth requirements for a particular device type, overhead, polling equipment, and web portals. *See id.,* Abstract; paras. [0038-0042]. In fact, the Examiner merely cites to Elliot in support of the assertion that Elliot discloses, "the parameter comprises interface bandwidth utilizes as a proportion of interface bandwidth capacity." *See* Final Office Action, p. 9.

Accordingly, the references, alone, or in any hypothetical combination, fail to show all of the limitations of claim 2. Appellants respectfully request that the Board reverse the rejection of claim 2 under 35 U.S.C. § 103(a).

F.   Ground of Rejection No. 6

The Appellants respectfully urge the Board to review and reverse the Examiner's sixth ground of rejection in which the Examiner rejected claims 5, 6, 12, 13, and 17 under 35 U.S.C. § 103(a) as being unpatentable over Umberger as applied in claim 1, 8, and 16 above, and in view of Courtright.

For at least the reasons discussed above, the cited references, alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claims 1, 8, and 16. Accordingly, claims 5, 6, 12, 13, and 17, which depend from claims 1, 8, and 16, are allowable over Umberger for at least the same reasons. Further, Courtright does not remedy the deficiencies of Umberger.

Rather, Courtright discloses a system controller for prioritized scheduling of I/O requests from prioritized clients. *See* Courtright, Abstract. Courtright does not disclose "assigning… an allowable utilization value at which… individual tasks are authorized to execute," as recited in claim 1. Rather, Courtright discloses placing I/O requests within queues and re-prioritizing I/O requests based on secondary prioritization factors. *See id.,* Abstract; col. 8, l. 63 – col. 9, l. 7. The Examiner merely cites to Courtright in support of the assertion that Courtright discloses, "maintaining a plurality of task queues." *See* Final Office Action, p. 10.

Accordingly, the references, alone, or in any hypothetical combination, fail to show all of the limitations of claims 5, 6, 12, 13, and 17. Appellants respectfully request that the Board reverse the rejection of the present claims under 35 U.S.C. § 103(a).

G.   Ground of Rejection No. 7

The Appellants respectfully urge the Board to review and reverse the Examiner's seventh ground of rejection in which the Examiner rejected claims 11 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Umberger as applied in claim 8, and 16 above, and in view of Guha.

For at least the reasons discussed above, the cited references, alone or in any hypothetical combination, fail to disclose all of the elements recited in independent claims 8 and 16. Accordingly, claims 11 and 18, which depend respectively from claims 8 and 16 are allowable over Umberger. Further, Guha does not remedy the deficiencies of Umberger.

Rather, Guha discloses a workload-adaptive storage system with data protection. *See* Guha, Abstract. Guha does not disclose "assigning… an allowable utilization value at which… individual tasks are authorized to execute," as recited in claim 1, and similarly recited in claims 8 and 16. Rather, Guha discloses selecting storage units and data organization schemes based on workload profiles and system constraints. *See id.*, Abstract; col. 9, ll. 7-51. The Examiner merely cites to Guha in support of the assertion that Guha discloses, "the parameter comprises host input/output operations per unit time, interface bandwidth as a proportion of bandwidth capacity, disk busy, disk transfers[, etc.]." *See* Final Office Action, p. 12.

Accordingly, the references, alone, or in any hypothetical combination, fail to show all of the limitations of claims 11 and 18. Appellants respectfully request that the Board reverse the rejection of the present claims under 35 U.S.C. § 103(a).

H. Request for Reversal of the Rejections

In view of the reasons set forth above, the Appellants respectfully request the Board to reverse the rejections of claims 1-8 and 10-20 under 35 U.S.C. §§ 101, 112, Second Paragraph, and 103(a).

Conclusion

The Appellants respectfully submit that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: March 4, 2010

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8. **APPENDIX OF CLAIMS ON APPEAL**

Listing of Claims:

1. A method of managing task execution in a storage system comprising:

measuring a parameter indicative of workload of an interface to a storage system; and

assigning priority of tasks executable on the system based on the measured

  parameter, wherein assigning comprises assigning to individual tasks an

  allowable utilization value at which the individual tasks are authorized to

  execute, wherein the allowable utilization value is indicative of

  importance of the task and correlative to the parameter.

2. The method according to Claim 1, wherein the parameter comprises host input/output operations per units time, and wherein measuring the parameter comprises counting a number of the host input/output operations per unit time.

3. The method according to Claim 1, wherein the parameter comprises interface bandwidth utilized as a proportion of interface bandwidth capacity.

4. The method according to Claim 1 further comprising:

maintaining a queue of tasks, the individual tasks having the assigned allowable

  utilization values;

measuring the parameter to obtain a current utilization value;

querying the tasks on the queue in the queue order;

executing a queried task that has an assigned allowable utilization value higher

  than the current utilization value; and

deferring to a next task on the queue, if any, for a queried task that has an

  assigned allowable utilization value lesser than the current utilization

  value.

5.   The method according to Claim 1 further comprising:

maintaining a plurality of task queues including the queue that bases execution on

      assigned allowable utilization and measured utilization, and at least a

      second queue with a priority that differs from the queue that is based on

      assigned allowable utilization and measured utilization.

6.   The method according to Claim 1 further comprising:

maintaining a high priority task queue for queuing and executing, in the queue

      order, tasks assigned a high priority; and

maintaining a utilization task queue for queuing and executing tasks, when the

      high priority queue is empty, in an order based in part on the order of

      queuing and in part on assigned allowable utilization value of a task and a

      measured current utilization value.

7.   The method according to Claim 1 further comprising:

maintaining a data structure associated with a utilization task queue indicative of

      allowable utilization of all tasks on the queue; and

executing or deferring execution of all tasks on the utilization task queue based on

      the data structure and a measurement of current utilization.

8.   An array controller comprising:

a physical interface capable of coupling to a storage array; and

a memory comprising control logic including code executable for the control

      logic comprising:

      a performance measurement utility that measures a parameter indicative of

            storage array input/output (I/O) workload; and

      a task management utility that assigns priority of tasks executable on the

            storage array based on the measured parameter, wherein each task

            is assigned a value of the parameter at which the task is authorized

            to execute if the measured parameter value is below the assigned

value, wherein the assigned value is indicative of a priority of the

task; and

a queuing utility that maintains a task queue and processes the tasks based

at least in part on the assigned values and the measured parameter

values.

10.   The array controller according to Claim 8, wherein the parameter
comprises a state of utilization of the I/O, and the assigned value comprises a threshold
utilization, and wherein the task management utility operates in combination with the
queuing utility and the performance measurement utility to: maintain a queue of tasks
with each task assigned the threshold utilization; periodically measure current utilization;
and execute tasks on the queue in the queue order so long as the current utilization meets
the task threshold utilization.

11.   The array controller according to Claim 8 wherein the parameter
comprises host input/output operations per unit time, interface bandwidth as a proportion
of bandwidth capacity, disk busy, disk transfers per second, kbyte throughput per second,
number of input/output operations per time interval, or input/output wait percentage, or
any combination thereof.

12.   The array controller according to Claim 8 wherein:
the executable code further comprises a queuing utility that maintains a plurality
of task queues including the queue that bases execution on assigned values
and on the measured parameter, and at least a second queue with a priority
that differs from the queue that is based on assigned values and on the
measured parameter.

13.   The array controller according to Claim 8 wherein:
the executable code further comprises a queuing utility that maintains a high
priority task queue for queuing and executing, in the queue order, tasks

assigned a high priority, and that maintains a utilization task queue for

queuing and executing tasks, when the high priority queue is empty, in an

order based in part on the order of queuing and in part on the assigned

value of a task and the measured parameter comprising a measured current

utilization value of I/O of the storage array.

14.   The array controller according to Claim 8 wherein:

the executable code further comprises a queuing utility that maintains a data

structure associated with a utilization task queue indicative of assigned

values comprising allowable utilization of all tasks on the queue, and that

executes or defers execution of all tasks on the utilization task queue based

on the data structure and a current measurement of the parameter

comprising current utilization.

15.   The array controller according to Claim 8 wherein:

the storage array is a Redundant Array of Independent Disks (RAID) array in a

structure selected from among RAID0, RAID1, RAID2, RAID3, RAID4,

RAID5, RAID6, RAID7, and RAID10.

16.   An array controller comprising:

a physical interface capable of coupling to a storage array; and

a memory comprising control logic including code executable for the control

logic comprising:

a performance measurement utility that measures a parameter indicative of

storage array input/output (I/O) workload;

a queue manager that maintains a task queue of tasks assigned a I/O workload

threshold value, wherein the threshold value is indicative of priority of the

task; and

a task management utility that executes tasks acting on the storage array with a

priority based on the storage array I/O workload parameter and the order

on the task queue.

17.   The array controller according to Claim 16 wherein the queue manager maintains a high priority task queue for queuing and executing, in the queue order, tasks assigned a high priority, and that maintains a utilization task queue for queuing and executing tasks, when the high priority queue is empty, in an order based in part on the order of queuing and in part on the assigned I/O workload threshold value to a task, and on a measured current I/O workload value of the storage array.

18.   The array controller according to Claim 16 wherein the performance measurement utility measures a performance criterion selected from among a group consisting of number of host input/output operations per unit time, interface bandwidth as a proportion of bandwidth capacity, disk busy, disk transfers per second, kbyte throughput per second, number of input/output operations per time interval, and input/output wait percentage.

19.   An article of manufacture comprising:

a controller comprising a computer readable medium having a computable

readable program code embodied therein for managing task execution in a

storage array, the computable readable program code comprising:

a code capable of causing the controller to measure a parameter indicative of

storage array input/output (I/O) workload comprising a sum of utilization

of an I/O device;

a code capable of causing the controller to assign priority of tasks executable on

the storage array based on the measured parameter; and

a code capable of causing the controller to maintain a queue of tasks with each

task assigned a threshold utilization, wherein the threshold utilization is

indicative of importance of the tasks.

20.   The article of manufacture according to Claim 19 wherein the computable readable program code further comprises:

a code capable of causing the controller to periodically measure current

utilization; and

a code capable of causing the controller to execute tasks on the queue in the queue

order so long as the current utilization meets the task threshold utilization.

9.   **<u>EVIDENCE APPENDIX</u>**

None.

10. **RELATED PROCEEDINGS APPENDIX**

None.